

Section 3: Beneficial Use Impairments Update

3.1 Introduction

A detailed beneficial use impairment assessment (BUIA) was presented in the Lake Erie LaMP 2000 document. It serves as the foundation for charting the future direction of the Lake Erie LaMP. Table 2 summarizes the impairment conclusions and causes of impairment as listed in the Lake Erie LaMP 2000 document. A full report for the Degraded Wildlife Populations and Loss of Wildlife Habitat BUIA was not yet complete for the LaMP 2000 report, so this section focuses heavily on the specific findings in that report. Also included are updates for several of the other BUIAs, although no changes in impairment conclusions have occurred during the last two years.

Table 2: Summary of Beneficial Use Impairment Conclusions from Lake Erie LaMP 2000 (updates for 2002 are noted in italics)

Use Impairment	Impairment Conclusions	Type of Impairment	Causes of Impairment
Fish & Wildlife Consumption Restrictions	Impaired	FISH* - sport fish consumption advisories in open and tributary waters of all basins. WILDLIFE - human consumption advisories for snapping turtles (including eggs) and waterfowl in NY waters, eastern basin. <i>Ohio will issue advisory for snapping turtles in 2002.</i>	FISH - PCBs, mercury, lead, chlordane, and dioxins WILDLIFE - PCBs, chlordane, DDE, DDT, mirex, <i>mercury, lead</i>
Tainting of Fish & Wildlife Flavor	Not Impaired	NONE	NONE
Degradation of Fish Populations	Impaired	Unmet fish population objectives; loss of spawning and nursery area; loss of population diversity; rare, threatened, endangered and special concern species; reduced predatory function; unnaturally high fish community instability; inefficient use of food web energy.	Habitat loss and degradation; non-indigenous species (exotics); forage fish availability reduced; over-exploitation; loss of native stocks/species, particularly keystone predators.
Degradation of Wildlife Populations	Impaired	Unmet wildlife population objectives; population fragmentation, isolation, and instability; loss or reduction in species indicative of quality habitat; loss of source populations; rare, endangered, threatened, and special concern species; accelerated parasitism/predation; competing uses of a given habitat; changes in ground temperature and moisture conditions in forested area; loss of travel lanes; loss of range/area-sensitive species (e.g. amphibians & reptiles, rails, bitterns, sedge wrens, bald eagle)	Fire suppression; logging; filling and draining of wetlands; high water levels, storm surges; dredging and channel modifications; water diversions; shoreline hardening and back-stopping; contaminated sediment; contaminant and nutrient loadings; navigation/boating activities; exotics.
Fish Tumors or Other Deformities	Impaired	Incidence rates of fish tumors or other deformities exceed rates at least impacted sites within the LE basin; presence of neoplastic or preneoplastic liver tumors in brown bullheads	PAHs (brown bullhead), unknown (other species)
Animal Deformities or Reproduction Problems	Impaired	Exposure above effect levels in bald eagle, herring gull, cormorant, common tern and eastern spiny softshell turtle; deformity impairments in mudpuppy; likely impairment in mink, river otter, snapping turtle, and frogs and toads	PCBs and other organochlorines, dieldrin (eagles), DDE, PAHs (mudpuppy), nitrates (frogs and toads)

Use Impairment	Impairment Conclusions	Type of Impairment	Causes of Impairment
Degradation of Benthos	Impaired	Degraded benthic community (composition and interactions among components) compared to reference conditions. Dominant species indicate degraded environment. Keystone species absent or nearly gone: *all basins - unionid mussels, <i>Gammarus</i> amphipods; *east & central basins - <i>Diporeia</i> amphipods; *east and western basins - fingernail clams; *middle of western basin - <i>Hexagenia</i> (mayflies). Unmet objectives for benthic density, biomass or productivity; toxicity to benthic organisms; elevated incidence of deformities or other abnormalities; contaminant burden is high enough that predators may be at risk of bioaccumulating toxics.	Contaminated sediments, non-indigenous species or exotics, loss and degradation of habitat particularly in wetlands
Restrictions on Dredging Activities	Impaired	Dredged materials require confined disposal in certain tributary mouths and harbors of all basins.	PCBs, heavy metals
Eutrophication of Undesirable Algae	Impaired	Maumee Bay, lake effect zones of Maumee/Ottawa Rivers, <i>western basin</i> ; nearshore and river mouth areas of Canadian <i>eastern basin</i> (excessive <i>Cladophora</i> ; P levels above Canadian guidelines in tributaries). Potentially impaired - lake effect zones of certain Ohio tributaries (degraded fish communities), <i>western and central basins</i> ; Rondeau Bay and nearby nearshore and river mouth areas, Canadian <i>central basin</i> .	Phosphorus
Restrictions on Drinking Water Consumption or Taste & Odor Problems	Not Impaired	NONE	NONE
Recreational Water Quality Impairments	Impaired (nearshore areas, all basins)	Exceedances of bacterial guidelines established to protect human health	<i>E. coli</i> and/or fecal coliform, PAHs**, PCBs**
Degradation of Aesthetics	Impaired	High turbidity; obnoxious odors; decaying <i>Cladophora</i> on the shoreline; seasonal fish die-offs because alewife/ other exotics are not acclimated to colder winter water temperatures; hindrances to recreational use due to floating garbage and debris/zebra mussels.	Excessive <i>Cladophora</i> , point/non-point source stormwater runoff, excessive floating garbage and debris, dead fish, excessive zebra mussels on shoreline areas.
Added Costs to Agriculture or Industry	Not Impaired	NONE	NONE
Degradation of Phytoplankton & Zooplankton Populations	Impaired	PHYTOPLANKTON - <i>eastern basin</i> - total standing crop and photosynthesis are below the potential set by P loading in the nearshore; loss of keystone species; loss of trophic transfer to <i>Diporeia</i> . ZOOPLANKTON - <i>eastern basin</i> - loss of dominant cold-water species; <i>eastern and west-central basins</i> - reduction in mean size points to potential impaired trophic transfer; <i>west central basin</i> - <i>Bythotrephes</i> acts as an energy sink; <i>western and central basin</i> lake effect zones - habitat loss and degradation.	Zebra and quagga mussel grazing; high planktivory.

Use Impairment	Impairment Conclusions	Type of Impairment	Causes of Impairment
Loss of Fish Habitat	Impaired	Unmet fish habitat objectives; loss of habitat diversity and integrity; loss of spawning/nursery areas; barriers to migration; changes in stream temperature, water quality and hydrology; high turbidity; loss of aquatic vegetation; changes to benthic species composition.	Destruction and draining of wetlands; dams, dikes, dredging/channel modifications, water taking; streambank/shoreline filling and hardening; sediment/chemical contaminant/nutrient loadings; navigation/recreational boating activities; exotics, <i>Cladophora</i> fouling (eastern basin nearshore)
Loss of Wildlife Habitat	Impaired	Unmet wildlife habitat objectives; habitat fragmentation and loss of niches; loss of diversity and integrity; population demands exceed available habitat (e.g. colonial waders that use the Lake Erie Islands); loss of stopover habitat along migratory corridors (birds, butterflies, bats); loss of cover for protection from predation; loss of or accelerated succession patterns; loss of area available for habitat expansion; loss of buffer functions between one habitat type and another; loss or reduction in quantity/quality of nesting/denning areas; loss or reduction in quantity/quality of food sources.	Fire suppression; logging; destruction and draining of wetlands; high water levels, storm surges; dredging/channel modifications, water taking, streambank/shoreline filling, hardening and backstopping; sediment/chemical contaminant/nutrient loadings; navigation/boating activities; exotics.

*Commercial fishermen in Ontario are prohibited from selling carp that are 32 cm or larger, due to PCBs.

** PAHs are the basis for a human contact advisory in the Black River Ohio Area of Concern and PCBs are the basis for a human contact advisory in the Ottawa River (Maumee Area of Concern).

Section 3

11

3.2 Degraded Wildlife Populations and Loss of Wildlife Habitat

A summary of the Degraded Wildlife Populations and Loss of Wildlife Habitat Technical Report (Lambert et al. 2001) has been completed. A wide variety of interest groups and agencies (wildlife managers, natural heritage biologists, academics, etc.) assisted in providing information and reviewing draft documents. There was consensus that habitats in Lake Erie are impaired and need attention.

Fifteen general habitat types and 300+ wildlife species were assessed for evidence of impairment in the Lake Erie basin. Terrestrial invertebrates were not assessed because they were not included in the ecosystem management objective modeling process developed for the Lake Erie LaMP. Wildlife populations or habitats were considered impaired if one or more of the definitions below applied to a species or habitat in one or more jurisdictions of the Lake Erie basin:

- o The wildlife population or amount or condition of habitat is below a stated objective (objectives were taken from management plans/strategies already underway and applicable to the Lake Erie basin);
- o The wildlife population or amount or condition of habitat is below the demand placed on it;
- o The wildlife population or habitat is rare, threatened, endangered, or of special concern;
- o The wildlife population or habitat is unable to sustain itself in terms of amount or condition;
- o Available data is insufficient or inconclusive, but the wildlife population or habitat is suspected to be degraded;
- o The wildlife population or habitat has contaminant burdens that may impair behavior or reproduction, either at that level or in higher trophic level organisms.

Table 3 identifies the impairment status of the habitats used in this assessment of the Lake Erie basin. Assessment of the selected general habitat types clearly indicated there was impairment; therefore, it was not necessary to conduct further assessments based upon individual vegetation communities or plant species.

Table 3: Summary of Lake Erie Wildlife Habitats and Their Impairment Status

Habitat	Impairment Status*
Islands	Impaired in OH; likely impaired in ON; do not occur in MI, NY and PA
Sand Beaches / Cobble Shore	Sand beaches impaired in OH, PA, NY, and ON; no MI assessment provided; cobble shore does not exist along Lake Erie shoreline in MI, is rare in ON and status is unknown in PA; where it does exist it is impaired
Unconsolidated Shore Bluffs	Impaired in PA; suspected impaired in NY and ON; do not occur in MI; not impaired in Ohio, but impacts to this habitat are key contributor to sand beach habitat impairment
Interdunal Wetlands	Impaired in OH, PA and ON; do not occur in NY; no MI assessment provided
Sand Dunes	Sand dunes and wooded beach ridges are impaired in OH, PA, NY and ON; no MI assessment provided; sand barrens are unique to Ohio and are impaired
Submerged Macrophytes	Impaired in PA, NY and ON; not impaired in OH; no MI assessment provided
Floating Macrophytes	Impaired in NY and ON; likely impaired in OH; suspected impaired in PA; no MI assessment provided
Emergent Macrophytes	Impaired in MI, PA, and NY; likely impaired in OH; suspected impaired in ON
Wet Meadow	Impaired in OH, PA, NY, and ON; no MI assessment provided
Mesic Prairie	Impaired in OH and ON; suspected impaired in PA; does not occur in the Lake Erie basin of NY; no MI assessment provided
Shrub Swamp	Impaired in OH and ON; suspected impaired in NY and PA; no MI assessment provided
Bogs and Fens	Impaired in OH, PA, NY and ON; no MI assessment provided
Upland Marsh	Impaired in OH and NY; suspected impaired in PA and ON; no MI assessment provided
Mesic Forest	Impaired in NY and ON; oak-hickory suspected impaired in OH; beech-maple suspected impaired in PA; no MI assessment provided
Swamp Forest	Impaired in OH, PA, NY and ON; no MI assessment provided

* Causes vary from historic human intervention, to natural, current practices, exotic species, and contaminants. Land use management provides the key to restoration.

The main cause of wildlife habitat impairment is the dramatic change to Lake Erie basin land use since European colonization began. Land use alterations have had an effect on almost all natural habitat-structuring forces (e.g., Lake Erie water levels, location of groundwater table, soil types and their associated nutrient values, bedrock, precipitation and associated storm surges, wind, fire, and the relative abundance of the wildlife species using a particular habitat). Human response to these structuring forces fall into three categories: 1) those that could not be changed must be protected against (water levels, precipitation, wind); 2) those deemed “undesirable” must be eliminated (fire, shallow groundwater); and 3) the “accidental” addition of new forces such as the introduction of exotic species and contaminants. The result has been, and continues to be, extreme pressure on both the natural functions of the habitat complex that historically

defined the region, and the wildlife populations that depend on these habitats.

The wildlife species and species guilds in this assessment were chosen based on a number of criteria including: consistency with the Lake Erie LaMP ecosystem management objectives modeling exercise; usefulness as an indicator of ecosystem health (particularly aquatic ecosystems) or wildlife function; existence of unmet objectives; and availability of data from monitoring programs. In this assessment, 16 amphibian species, 27 reptile species, 14 mammal species, 200+ bird species (36 individual species/10 guilds) were evaluated. A guild is a group of species with similar roles in the wildlife community due to similar ecological resource requirements and foraging strategies. Bird guilds assessed included dabbling ducks, diving ducks, mergansers, migrant passerines, breeding passerines, shorebirds, marsh birds, migrant raptors, herons and egrets, and gulls and terns.

Of the 300+ wildlife species assessed, 38 (10 reptiles, 5 amphibians, 19 birds, 4 mammals) were clearly impaired in all five Lake Erie jurisdictions, in all Lake Erie jurisdictions that provided data, or in all Lake Erie jurisdictions that are known to be within their range. An additional 11 (2 reptiles, 3 amphibians, 6 birds) were impaired in four out of five Lake Erie jurisdictions, in all but one of the Lake Erie jurisdictions that provided data, or in all but one of the Lake Erie jurisdictions that are known to be within their range.

Wildlife species that are largely or totally limited to the Lake Erie basin, species for which jurisdictions in the basin have a high stewardship responsibility, or species suspected or proven to be adversely affected by contaminants were highlighted in the report. As examples, the eastern fox snake and the Lake Erie water snake are both endemic to the Great Lakes basin.

The eastern fox snake inhabits coastal marshes and other nearshore areas along southern Lake Huron, Lake St. Clair and the Detroit River, east along the northern Lake Erie shore to Long Point Bay (Norfolk County, Ontario) and along the southern Lake Erie shore in the extensive marshes of Lucas, Ottawa, Sandusky, and Erie counties in Ohio. On Lake Erie, fox snakes inhabit Pelee Island and other islands. In Ontario, the western basin of Lake Erie, Long Point, Rondeau, Pelee Island, and Point Pelee comprise over 50% of the eastern fox snake's global range. The eastern fox snake does not occur in the Lake Erie basin of New York or Pennsylvania; however, it is

impaired in all of the other jurisdictions bordering Lake Erie (i.e. Michigan, Ohio, and Ontario). The eastern fox snake has legal protection in Michigan and Ontario and is listed as threatened in both jurisdictions. In Ohio, the eastern fox snake is considered a species of special interest (a designation assigned to species, or subspecies, that might become threatened in Ohio under continued or increased stress). In Canada it was listed as threatened in 2000.

The Lake Erie water snake is a semi-aquatic reptile entirely dependent on specialized western Lake Erie island habitat (rocky shoreline areas and nearshore waters). The total range of this species is divided between Ontario (4,138 ha or 62% of its global range) and Ohio (2,479 ha or 38% of its global range). Some of the major islands where this subspecies occurs include Middle Island, East Sister Island, Hen Island and Pelee Island in Ontario, and South Bass, Middle Bass, North Bass and Kelleys islands in Ohio. Historically, the Lake Erie water snake occurred on the Ohio mainland, two or more nearshore Ohio islands, and 22 or more offshore islands and rock outcrops. Today, the Lake Erie water snake has disappeared from four islands (West Sister Island and Green Island in Ohio and Middle Sister Island and North Harbour Island in Ontario), and has declined significantly on the remaining islands. The current estimate for the U.S. population ranges from 1,530 to 2,030 adults and is restricted to only eight islands. Recent data show that the number of Lake Erie water snakes has declined by 75% on North Bass Island and by 81% on Middle Bass Island - two key study sites in Ohio. In Canada, the population of Lake Erie water snakes could number over 1,600 adults, based on maximum population estimates from surveys in the early to mid-1980s. Human persecution of this subspecies on the islands, as exemplified by



Photo: Scott Gillingwater

an extermination program on Middle Island, has likely contributed to the species' decline over the years. Persecution by humans is still a serious problem on several islands. The Lake Erie water snake is listed as endangered in Canada and threatened in the U.S. and has endangered status in both Ohio and Ontario. Over the past 60 years, key shoreline habitat within the Lake Erie water snake's range has been altered, degraded, and developed through the construction of cottages, marinas, docks, sea walls, the filling of lagoons, and quarry mining. Contaminant concentrations (PCBs) in Lake Erie water snakes from Pelee Island are high enough to justify a study of health and reproductive effects.

The objectives and priorities of several existing wildlife and habitat management plans were used in the evaluation of habitats and wildlife in the Lake Erie basin. Management plans target specific objectives and goals for their planning regions (many of which fall within the Lake Erie basin); natural heritage plans help identify priority species or habitats in need of protection; recovery plans outline the biology, threats and limiting factors, research needs, and recovery goals for endangered and threatened species; and a variety of conservation plans provide guidelines for the protection of habitats and biodiversity. Some of the key management programs: recovery plans, natural heritage plans and conservation plans consulted for this habitat and wildlife assessment are outlined in the BUIA report.

3.3 Next Steps

Information on habitat and wildlife impairments from this assessment will be used in the development of a habitat strategy for the Lake Erie LaMP and will help focus habitat protection, restoration, and enhancement efforts in the Lake Erie basin. Information gathered from this assessment and other beneficial use impairment assessments have also contributed to the development of draft ecosystem objectives for Ecosystem Alternative 2.

Lake Sturgeon Making a Comeback

In 2001, 21 sturgeon were reported in Ohio waters. Lake sturgeon provided a lucrative commercial fishery across the Great Lakes in the mid-1800s for caviar and smoked fish. Historically, Lake Erie produced the largest number of sturgeon in the Great Lakes. Over-fishing, pollution and damming of rivers greatly reduced the populations by the early 1900s. A slow maturity rate was also a factor, as a female sturgeon doesn't spawn until 20 years of age, and then only every 4 to 7 years. Recent observations and catches of this prehistoric-looking fish have fishery biologists hoping for a reversal in the lake sturgeon's diminished presence in Lake Erie. Especially noteworthy are a number of catches of juvenile sturgeon three to six years old (measuring 14 to 24 inches), and a 7-inch fish, spawned last spring, suggesting sturgeon are reproducing in Lake Erie. Of concern to New York States biologists are the 27 dead sturgeon that washed onto shore in 2001, possibly suffering from a botulism outbreak.



Photo: Gene Emond

One of the sturgeon reported in Ohio waters this year was the recapture of a fish tagged from a current monitoring project in the Lake St. Clair and Detroit River region; the first recapture outside the Lake St. Clair/Detroit River system. Since 1995, more than 4,000 sturgeon have been tagged. Recaptures of these highly migratory fish, aid in the population and habitat management of this species. Overall biologists are very optimistic about the comeback of Lake Erie's sturgeon and hope to someday find evidence of spawning grounds. A Cleveland angler caught a 5 1/2-foot sturgeon on the Cuyahoga River last September. Two adult sturgeon caught in the Maumee River last year could be an indication that sturgeon are returning to these streams.

3.4 Fish BUIA Update

The major points on fish BUIAs from the LaMP 2000 report were that the fish community was unstable due to loss of habitat, loss of top fish predator stocks, negative impacts of non-indigenous species (exotics) and inefficient flow of energy through the food web. These factors continue to create instability in the Lake Erie fish community.

Since 2000, round gobies have spread throughout Lake Erie and have increased in abundance. They are now among the most abundant fish species on rocky substrates, feeding on a variety of organisms ranging from plankton to zebra mussels and other benthic invertebrates to fish eggs. They also have become a major prey of essentially all benthic fish predators, including smallmouth bass, yellow perch, walleye, and freshwater drum. In July 2001, the first tubenose goby was captured in western Lake Erie. Given the St. Clair River experience (where both tubenose and round gobies were initially found but round gobies eventually dominated), it is anticipated that tubenose gobies will not substantially add to the impacts of the round goby.

Walleye stocks should improve in the near future as Lake Erie's five fisheries management agencies support a Coordinated Percid Management Strategy, which will significantly reduce fishing mortality on walleye through 2003. The strategy also allows for the further development of adaptive fishery management on an interagency level. Strong walleye hatches in 1999 and 2001 should bolster the adult stocks in coming years with improved survival rates that result from reduced fishing. Yellow perch stocks should also benefit from the Coordinated Percid Management Strategy.

A five-year fisheries restoration program has been initiated by Ontario for eastern Lake Erie. In cooperation with the New York State Department of Environmental Conservation, Ontario is establishing regulations for conservative harvest, initiating a major stock assessment program, and implementing a program of fisheries inventory and habitat assessment for nearshore waters and lake-affected zones of rivers.

Positive signs in the western basin fish community are that white bass stocks appear to be increasing in abundance and prey fish populations have recovered from low levels during the mid-1980s. Increased populations of mayflies have increased the forage base for many fish species, including yellow perch. The silver chub, a benthic-feeding high-energy food source for other fish, is reappearing in abundant numbers. The silver chub practically disappeared from the lake simultaneously with the catastrophic decline of the mayfly in the early 1950s (Troutman, 1981). Coincidentally, silver chubs feed on zebra mussels. Trout-perch, another benthic species that declined dramatically in the 1950s, is also making a comeback. These changes suggest that the historic benthic-feeding community in Lake Erie is beginning to recover (Thoma, personal communication).

